Paraglacial evolution of Conway glacier complex foreland, Northwestern Spitsbergen, Svalbard

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This study aims to provide information concerning paraglacial evolution of landforms and sediments in a proglacial area in the Kongsfjorden area. Several subjects are emphasized:
1- chronology of deglaciation
2 - morphology of landforms
3 - sedimentology of deposits
4 –disintegration of the moraine complex by contemporary processes

1 – Study area
Conwaybreen catchment is located in the Kongsfjorden area on the western coast of Spitsbergen (79°N, 12°45'E). In 1980, this glacier was 16,6 km length and its area was estimated to 56,60 km², with an equilibrium line estimated to be *circa* 460 m a.s.l. During the Little Ice Age, Conwaybreen was in contact, on its right side, with a small glacier (about 3 km²) named Baronbreen, and at its front, Conwaybreen was in contact with the Feiringbreen (7,6 km²) (fig. 1). Culmination of the Little Ice Age occurred at the beginning of the XXth century in this part of Arctic, and many glaciers had their maximum Holocene extent at that time. The study area corresponds to the proglacial area of this glacial complex and is located just above contemporary sea level. Glaciers retreat had released huge volumes of melt water which have created several typical landforms and enhanced sediment fluxes. Both will be examined here.

2 – Landforms
The Conwaybreen foreplain consists on a patchwork of glacial and fluvioglacial deposits that are reworked or built by paraglacial processes. Morainic deposits, alluvial fans, lacustrines deposits or kame terrace have been identified. Their stratigraphic and sedimentologic characteristics help to reconstruct the evolution of the proglacial area during the heterochronic retreat of the three glacial tongues acting in the study area.

3 – Sediment analysis
Sediment analyses of a proglacial alluvial fan lying between the 2 glacial tongues reveal a succession of geomorphic events where high energy sedimentation alternates with low energy rythmic sedimentation (fig. 2). A glaciolacustrine sequence and a kame terrace suggest the temporary storage of Baronbreen meltwater behind an ice-dam built by the Conwaybreen front.

4 – Interpretation: Geomorphic sequence of ice retreat
A glacier retreat timetable will be proposed in a palaeogeographical reconstruction sequence based upon aerial photographs interpretation, and proglacial landforms analysis. Four stades can be identified:
1 – At the end of the LIA, Conwaybreen, Baronbreen and Feiringbreen show their maximum extent. Glacial dynamics built huge front and lateral moraines.
2 – The paraglacial sequence starts in the first years of the twentieth, with a glacial retreat clearly visible on 1936 aerial photographs. But the Baronbreen retreat is faster than the Feiringbreen and Conwaybreen, because it is a very small glacier which responds quickly to climate change. This differential retreat allows the Conwaybreen to dam meltwater and solid fluxes coming from the Baronbreen. So, a kame terrace and lacustrine deposits appear beside the glacial dam.
3 – The third stade is a paraglacial crisis inside the post-LIA paraglacial sequence: breakage of the mediane moraine between Baronbreen and Conwaybreen leads to the brutal release of the lake water (jökulhalup) which reworks sediments on the deglaciated foreplain of the Conwaybreen.
4 – The last and contemporary sequence corresponds to the destruction of the moraines (dead ice melting) and the paraglacial adjustement of slope deposits. Mud-flows and debris flows appear now as the most dynamic processes acting on these landforms. Alluvial fans and cones stand downstream. This dead-ice melting

dynamics is still and brutal at the same time and corresponds to different tresholds.

Conclusion

Palaeogeographic reconstructions, sedimentological results, analysis of accumulation forms, all contribute to show the strong energy of paraglacial dynamics in a geomorphological sequence of fast glacial withdrawal, under the impact of current climatic changes. The identification of the paraglacial deposits represents a considerable projection for the palaeo-environmental reconstructions. This sharp interpretation (the Conwaybreen glacier always records in 2006 a noticeable retreat) is new and makes it possible to understand the older deposits associated with former deglaciations in Spitsbergen and in the other fields having been englaciated in the world.

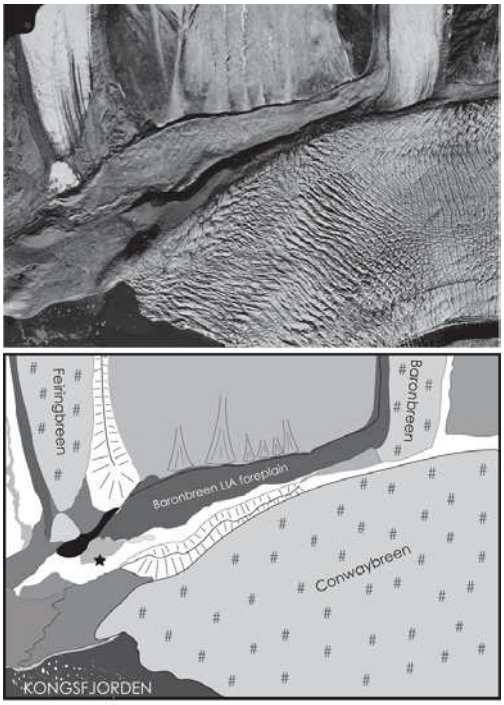

Figure 1. Aerial view of the Baronbreen glacial foreplain

★ sediment log

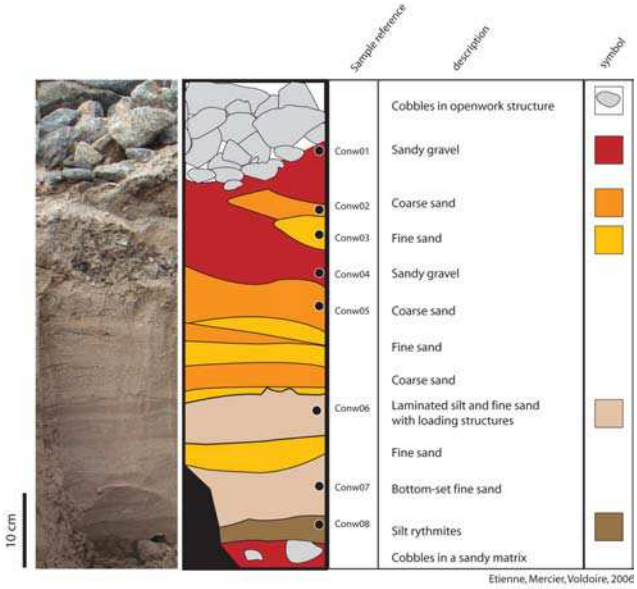

Figure 2 - Lithofacies of the Baronbreen fan, Spitsbergen